इंटरनेट मानक

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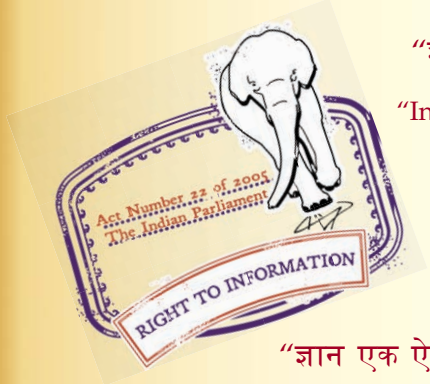
IS 10721 (1983): Datum and datum systems for geometrical tolerancing on technical drawings [PGD 24: Drawings]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS : 10721-1983
ISO 5459-1981

UDC 744·4 : 621·753·1 (First Reprint AUGUST 1992)

(Reaffirmed 1999)

Indian Standard

DATUM AND DATUM SYSTEMS FOR GEOMETRICAL TOLERANCING ON TECHNICAL DRAWINGS

(ISO Title : Technical Drawings — Geometrical Tolerancing — Datums and Datum-Systems for Geometrical Tolerances)

Drawings Sectional Committee, EDC 20 : Drawing Subcommittee, EDC 20 : 1 [Ref. : Doc : EDC 20 (4089)]

National Foreword

This Indian Standard, which is identical with ISO 5459-1981 'Technical drawings — Geometrical tolerancing — Datums and datum-systems for geometrical tolerances', issued by the International Organization for Standardization (ISO), was adopted by the Indian Standards Institution on recommendation of the Drawings Sectional Committee and approved by the Engineering Division Council.

Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

Cross Reference

International Standard	*Corresponding Indian Standard*
ISO 128-1982	IS : 10714-1983 General principles of presentation in technical drawings (Identical)
ISO 129	IS : 696-1972 Code of practice for general engineering drawings (*second revision*) (Technically equivalent)
ISO 1101/1	IS : 8000 (Part 1) - 1976 Tolerances of form and of position for engineering drawings : Part 1 Generalities, symbols, indications on drawings (Technically equivalent)
ISO 2692	IS : 8000 (Part 2) - 1976 Tolerances of form and of position for engineering drawings : Part 2 Maximum material principles (Technically equivalent)

There is no Indian Standard corresponding to ISO 7083 to which reference is made in 2.

Adopted 16 August 1983	July 1984, BIS	Gr 8

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0 Introduction

For uniformity all figures in this International Standard are in first angle projection.

It should be understood that the third angle projection could equally well have been used without prejudice to the principles established.

For the definitive presentation (proportions and dimensions) of symbols for geometrical tolerancing, see ISO 7083.

1 Scope and field of application

This International Standard describes datum and datum-systems for geometrical tolerancing, their definitions, practical embodiments and their indications on technical drawings in the field of mechanical engineering.

2 References

ISO 128, *Technical drawings — General principles of presentation.* [1]

ISO 129, *Engineering drawings — Dimensioning.* [2]

ISO 1101, *Technical drawings — Geometrical tolerancing — Tolerances of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.* [3]

ISO 2692, *Technical drawings — Geometrical tolerancing — Maximum material principle.* [4]

ISO 7083, *Techical drawings — Symbols for geometical tolerancing — Proportions and dimensions.* [5]

3 Definitions

3.1 datum : A theoretically exact geometric reference (such as axes, planes, straight lines, etc.) to which toleranced features are related. Datums may be based on one or more datum features of a part.

3.2 datum-system : A group of two or more separate datums used as a combined reference for a toleranced feature.

3.3 datum feature : A real feature of a part (such as an edge, a surface, or a hole, etc.), which is used to establish the location of a datum.

NOTE — As datum features are subject to manufacturing errors and variations, it may be necessary where appropriate to specify tolerances of form to them.

3.4 datum target : A point, line or limited area on the workpiece to be used for contact with the manufacturing and inspection equipment, to define the required datums in order to satisfy the functional requirements.

3.5 simulated datum feature : A real surface of adequately precise form (such as a surface plate, a bearing, or a mandrel, etc.) contacting the datum feature(s) and used to establish the datum(s).

NOTE — Simulated datum features are used as the practical embodiment of the datums during manufacture and inspection.

1) At present at the stage of draft. (Revision of ISO/R 128-1959.)

2) At present at the stage of draft. (Revision of ISO/R 129-1959.)

3) At present at the stage of draft. (Revision of ISO/R 1101/1-1969.)

4) At present at the stage of draft. (Revision of ISO/R 1101/2-1974.)

5) At present at the stage of draft.

4 Establishing datums

Features indicated as datums have inherent inaccuracies resulting from the production process. These may take the form of convex, concave or conical deviations. The following methods are examples for establishing datums.

4.1 Datum being a straight line or a plane

The datum feature shall be arranged in such a way that the maximum distance between it and the simulated datum feature has the least possible value. Should the datum feature not be stable with the contacting surface, suitable supports should be placed between them at a practical distance apart. For lines, use two supports (see figure 1) and for flat surfaces, use three supports.

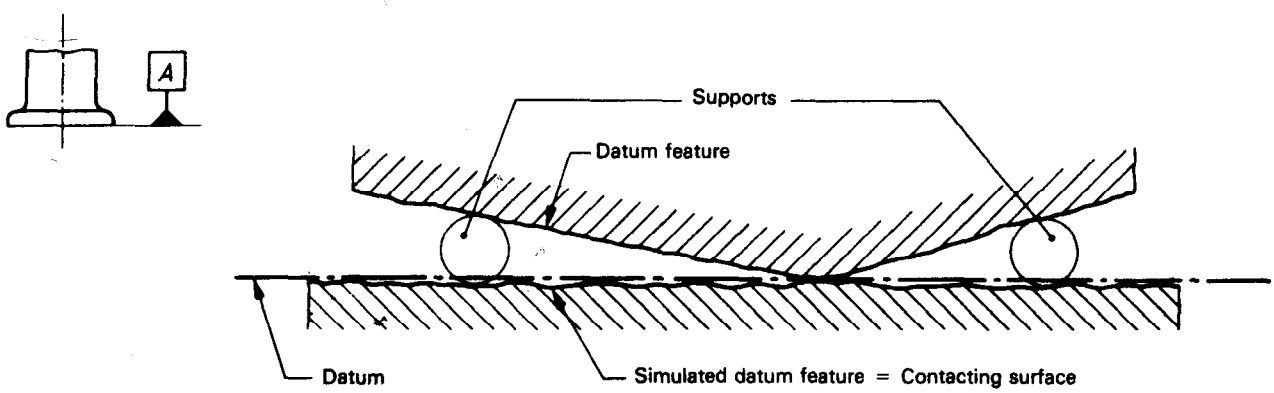


Figure 1

4.2 Datum being the axis of a cylinder

The datum is the axis of the largest inscribed cylinder of a hole or the smallest circumscribed cylinder of a shaft, so located that any possible movement of the cylinder in any direction is equalised (see figure 2).

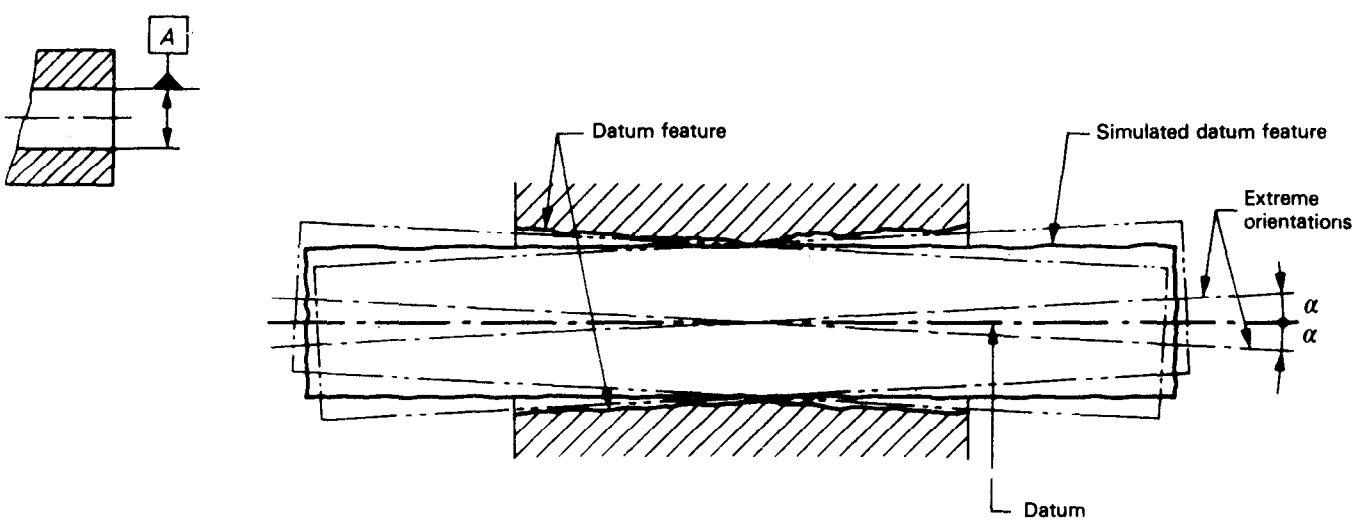


Figure 2

4.3 Datum being the common axis or common median plane

In the example shown in figure 3, the datum is the common axis formed by the two smallest circumscribed coaxial cylinders.

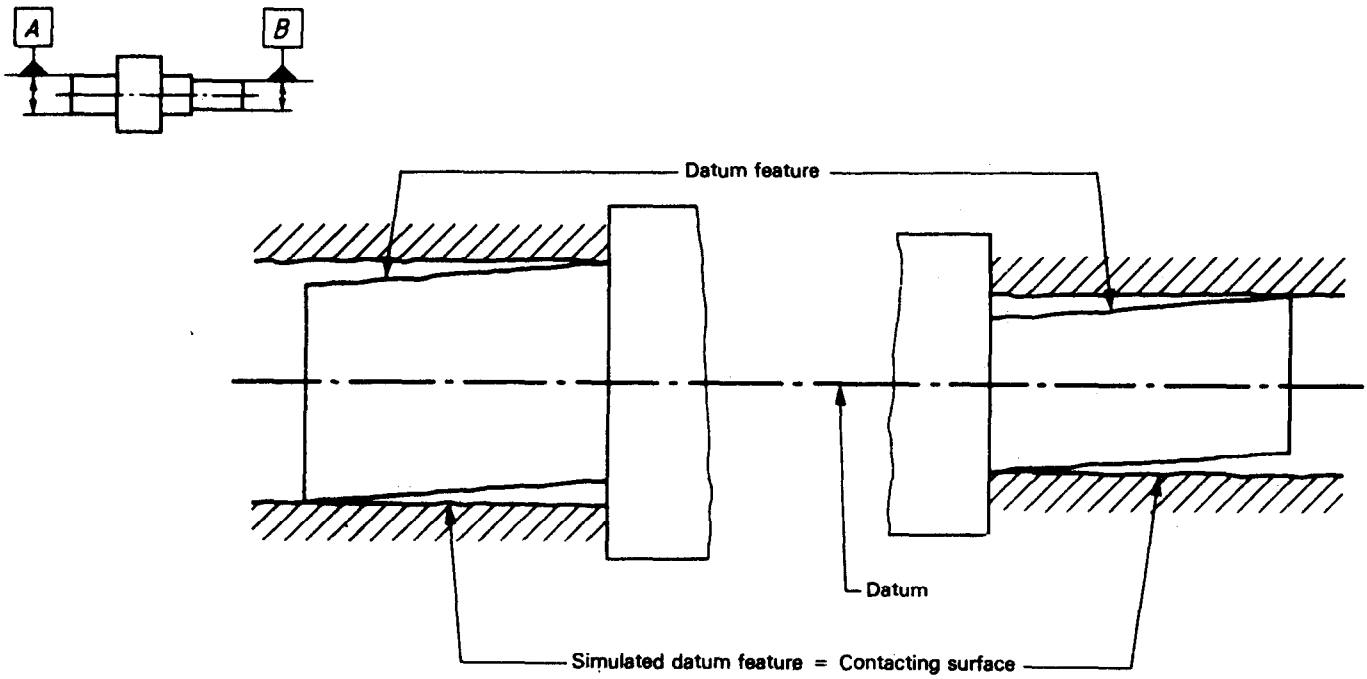


Figure 3

4.4 Datums being the axis of a cylinder and perpendicular to a plane

The datum "A" is the plane represented by the contacting flat surface.

The datum "B" is the axis of the largest inscribed cylinder, perpendicular to the datum "A".

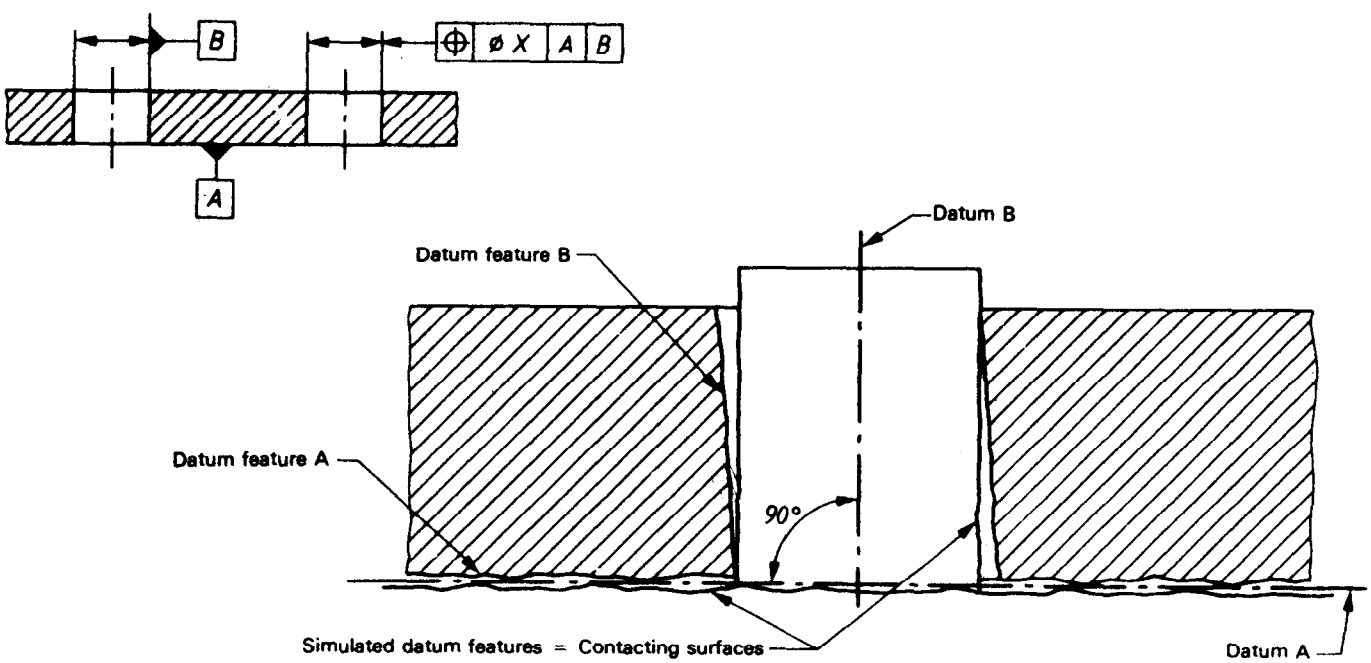


Figure 4

NOTE — In the above example the datum "A" is considered to be primary and the datum "B", secondary (see 6.2.3).

5 Application of datums

Datums and datum-systems are used as the base for establishing the geometric relationship of related features. The quality of relevant datum features and simulated datum features must be adequate for functional requirements.

The following table shows :

- the indication of datums on technical drawings;
- the datum features;
- how datums are established by means of simulated datum features.

Table — Examples

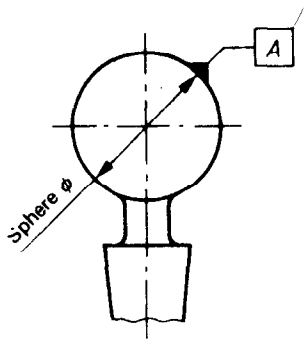
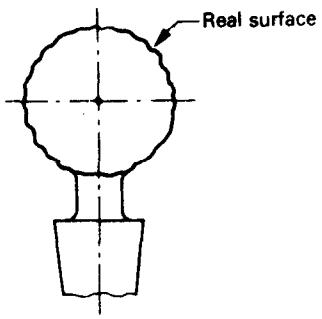
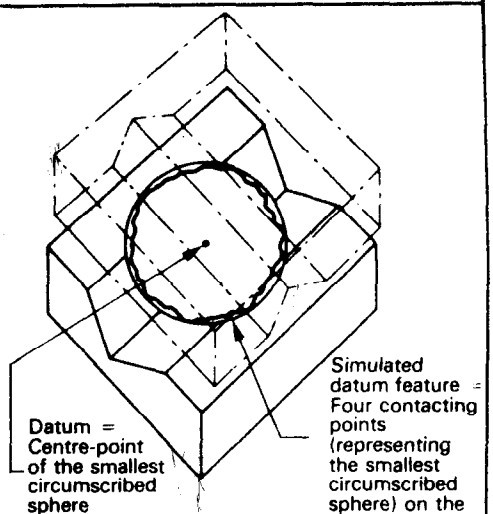
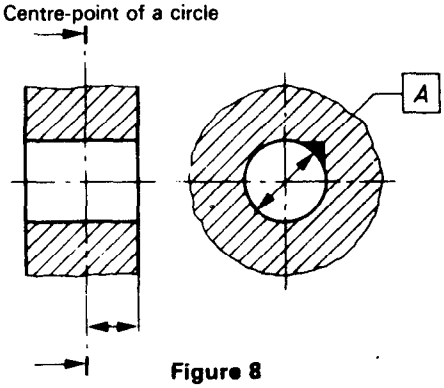
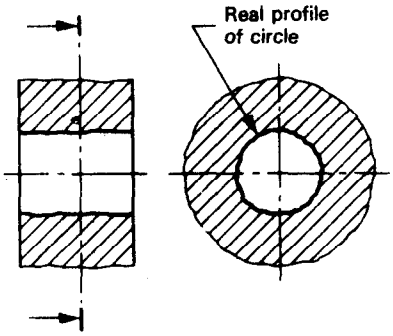
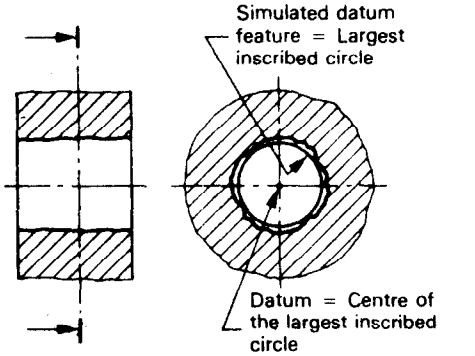
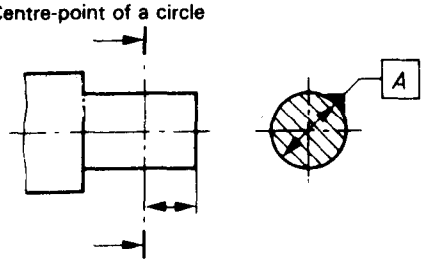
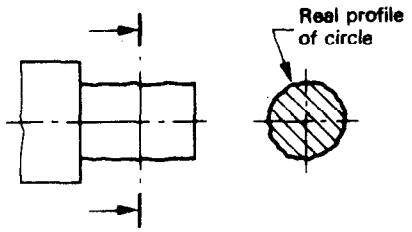
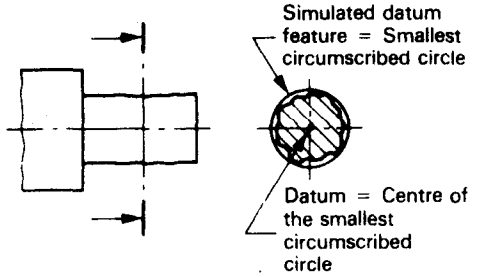
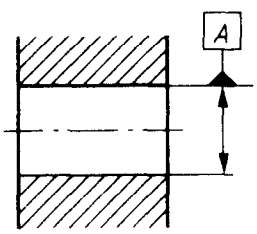
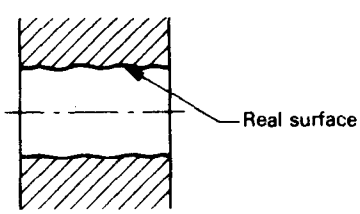
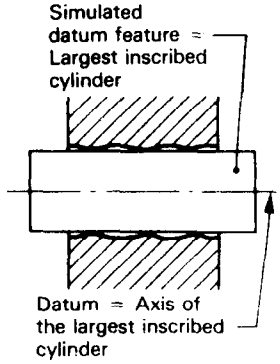
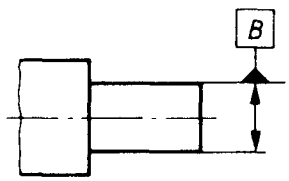
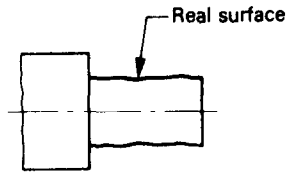
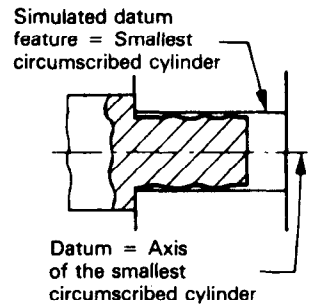
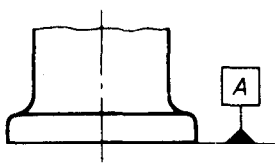
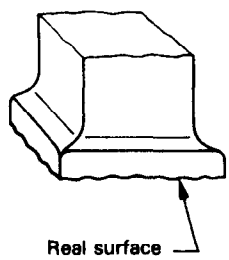
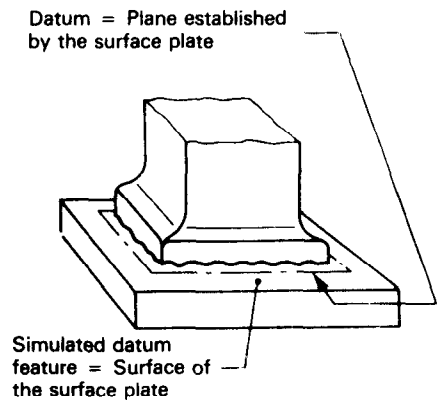
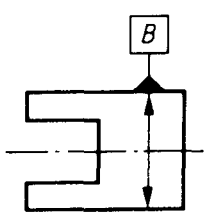
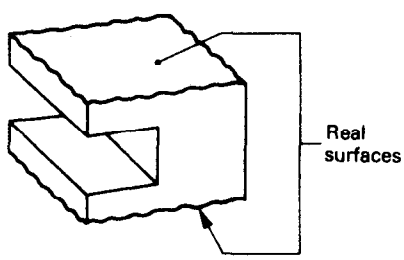
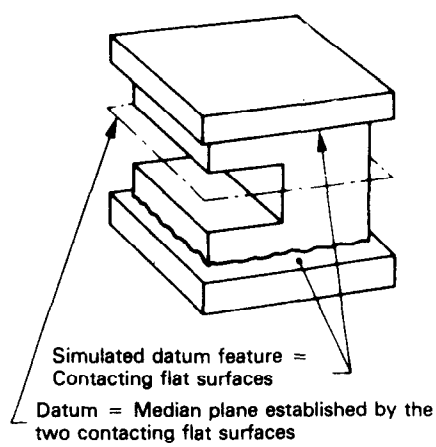
Datums	Datum features	Establishment of datums
Datum - centre-point Centre-point of a sphere  **Figure 5**	 **Figure 6**	 **Figure 7**
Centre-point of a circle  **Figure 8**	 **Figure 9**	 **Figure 10**
Centre-point of a circle  **Figure 11**	 **Figure 12**	 **Figure 13**
Datum-line Axis of a hole  **Figure 14**	 **Figure 15**	 **Figure 16**

Table — Examples (*concluded*)

Datums	Datum features	Establishment of datums
Axis of a shaft  Figure 17	 Figure 18	 Figure 19
Datum-plane Surface of a part  Figure 20	 Figure 21	 Figure 22
Median plane Median plane of the two surfaces of a part  Figure 23	 Figure 24	 Figure 25

6 Indication of datums and datum-systems

6.1 Datum symbols

6.1.1 Datum triangle

The datums are indicated by a leader line terminating in a filled or an open triangle (see figure 26).

6.1.2 Datum letter

To identify a datum for reference purposes, a capital letter is enclosed in a frame connected to the datum triangle (see figure 27).

If the tolerance frame can be connected in a clear and simple manner with the datum by a leader line, the datum letter may be omitted (see ISO 1101).

Figure 26

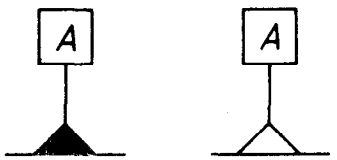


Figure 27

6.2 Datum and datum-systems specified in the tolerance frame

A datum may be established by one or more features. The following procedures should be used as appropriate.

6.2.1 Datum established by a single feature

Where the datum is established by a single feature, the datum is indicated by a single letter in the third compartment of the tolerance frame.

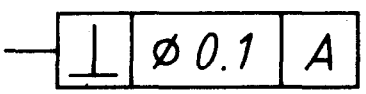


Figure 28

6.2.2 Common datum established by two features

Where the common datum is established by two features, the datum is indicated in the third compartment of the tolerance frame by two letters separated by a hyphen

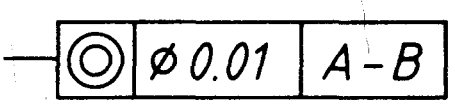


Figure 29

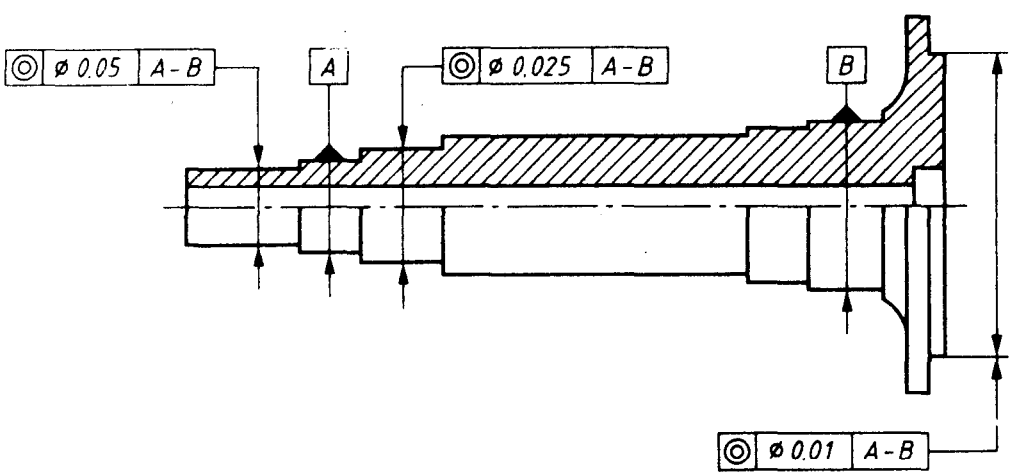


Figure 30

6.2.3 Datum-system established by two or more features

Where a datum system is established by two or more features, i.e. multiple datums, their datum letters are indicated in the third and subsequent compartments of the tolerance frame, in accordahce with the sequence of the datums.

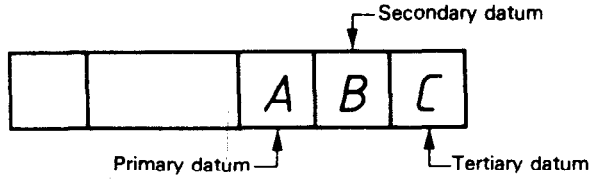


Figure 31

Indication on the drawing

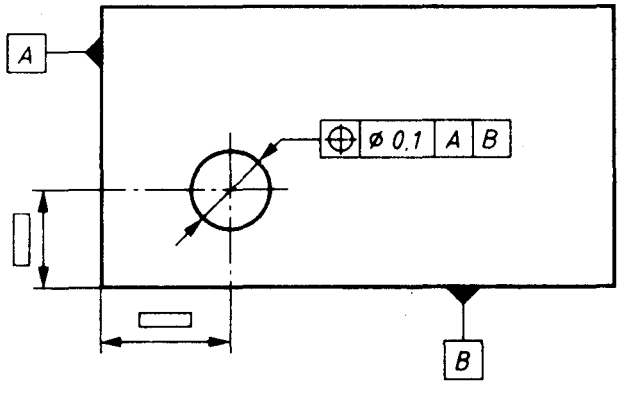


Figure 32

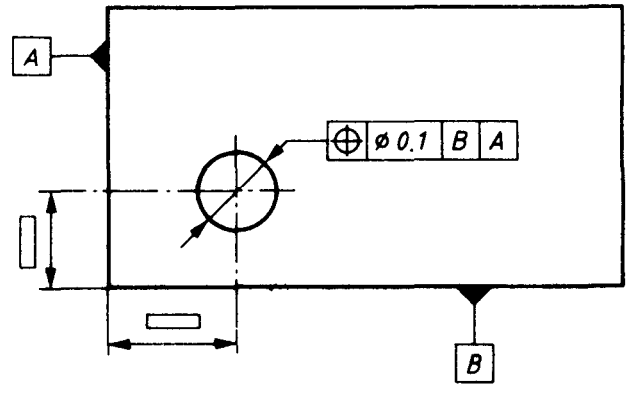
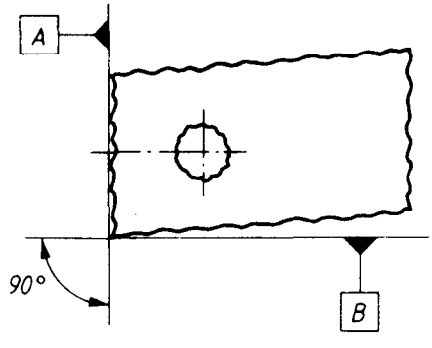


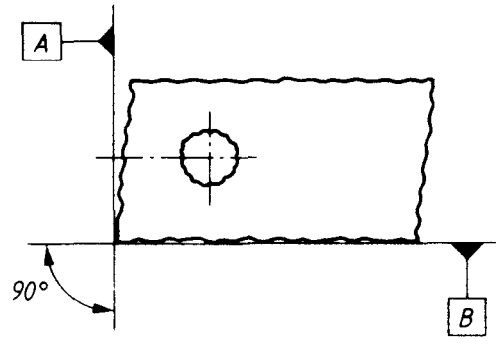
Figure 33

The sequence of the datums is of considerable influence to the result obtained.

Results



A = Primary datum
B = Secondary datum



B = Primary datum
A = Secondary datum

Figure 34

Example

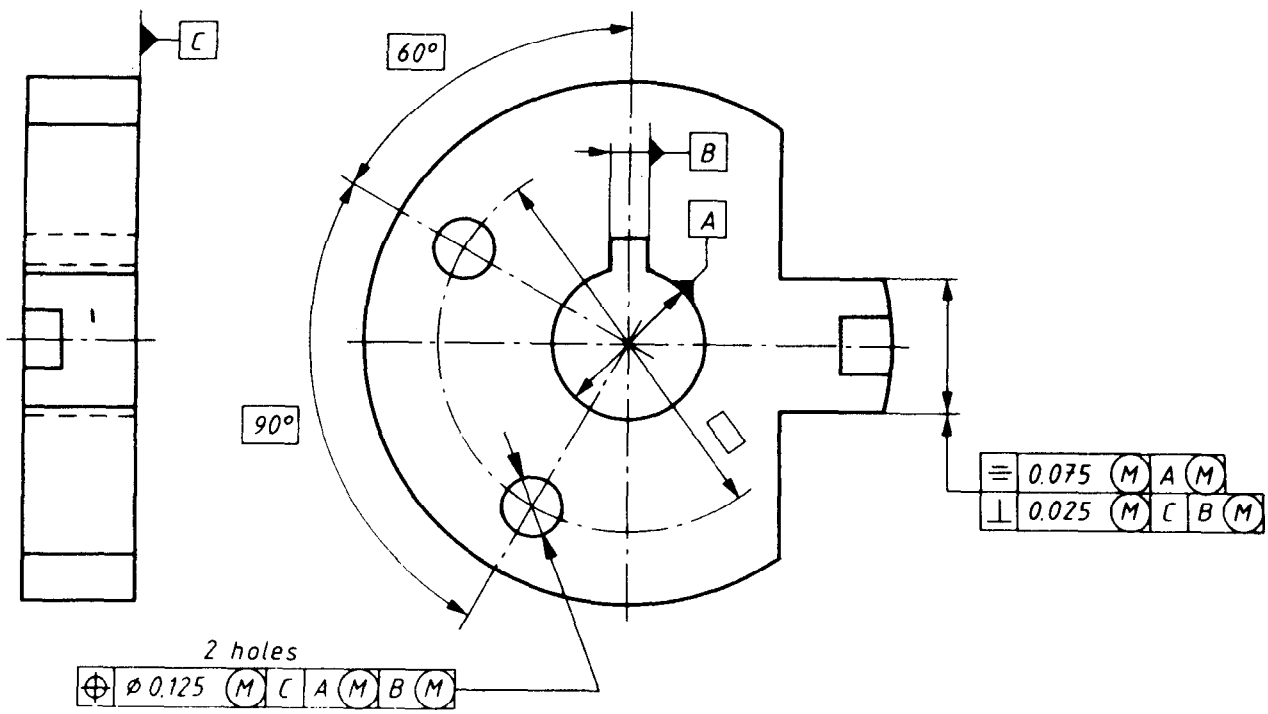


Figure 35

7 Datum targets

In the case of a surface, the datum feature may vary significantly from its ideal form. Thus, specification of a total surface as a datum feature may introduce variations or lack of repeatability in measurements taken from it (see figures 36 and 37).

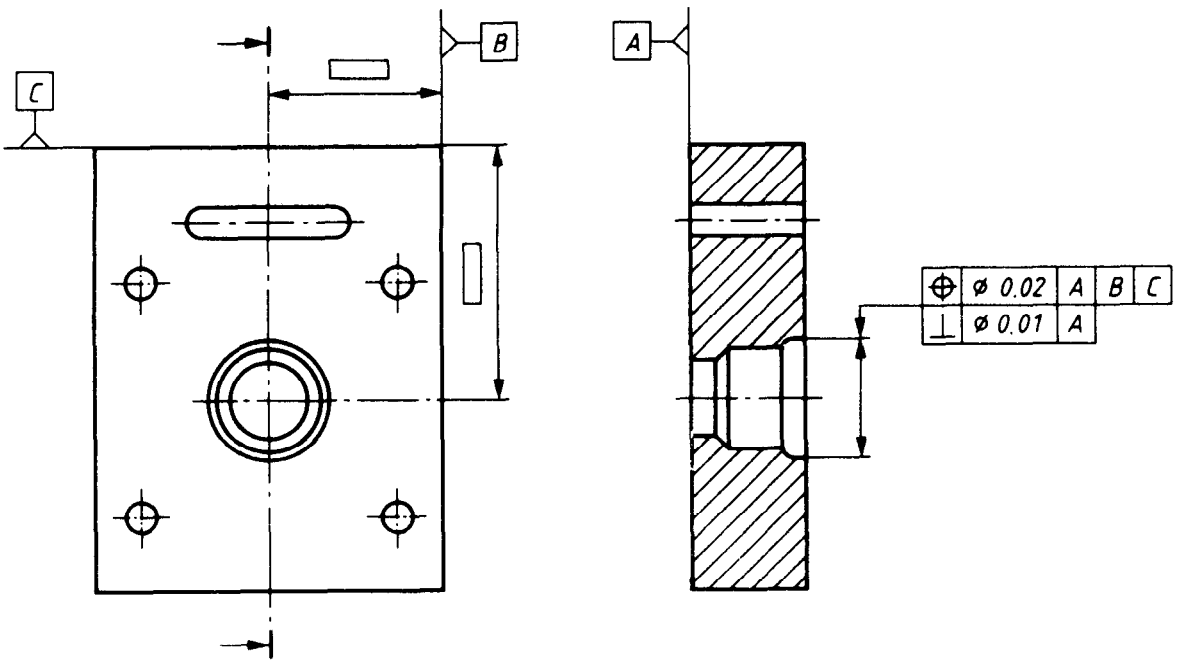


Figure 36

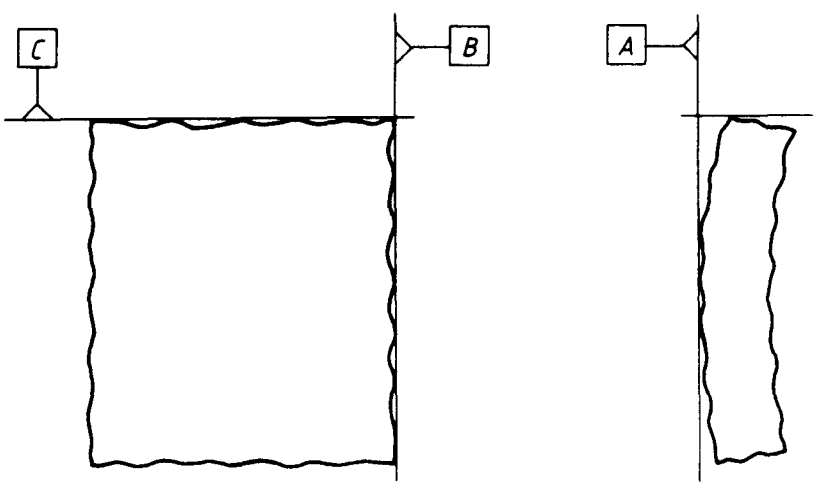


Figure 37

It may therefore be necessary to introduce datum targets.

Before specifying the datum targets, it is necessary to consider whether the functioning of the part may be endangered by specifying the datum to consist only of datum targets instead of the whole surface. In this respect the influence of the deviations from the ideal geometrical form and positions, which may occur, shall be considered.

7.1 Symbols for datum targets

To indicate the datum targets on a drawing, the following symbols shall be used.

7.1.1 Datum target frame

The datum targets are indicated by a circular frame divided in two compartments by a horizontal line. The lower compartment is reserved for a letter and a digit. The letter represents the datum feature and the digit the datum target number.

The upper compartment is reserved for additional information, such as dimensions of the target area. If there is not sufficient space within the compartment, the information may be placed outside and connected to the appropriate compartment by a leader line.

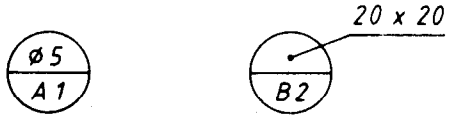


Figure 38

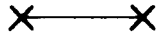
The datum target frame is connected to the datum target symbol by a leader line, terminated by an arrow.

7.1.2 Datum targets

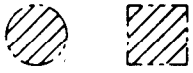
If the datum target is

— a point : it is indicated by a cross,

— a line : it is indicated by two crosses, connected by a thin continuous line



— an area : it is indicated by a hatched area surrounded by a thin double dashed chain line



The symbols shall be placed on that view of the drawing which most clearly shows the relevant surface (see figure 42). The locations of the datum targets may be dimensioned on that view which is most convenient, preferably in a full view.

Examples

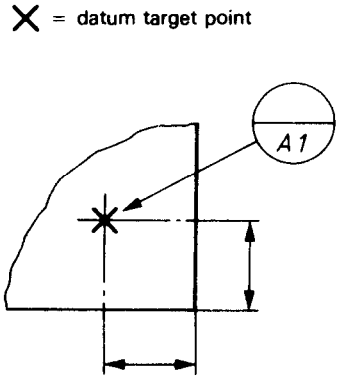


Figure 39

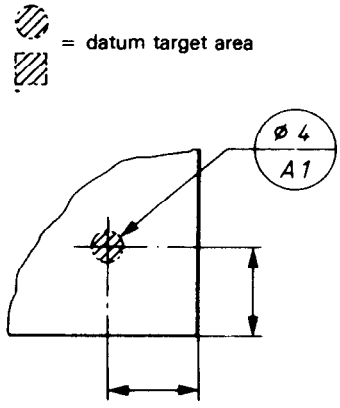


Figure 40

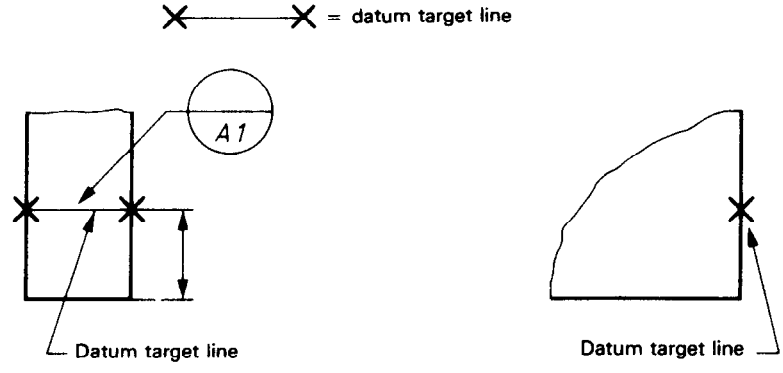
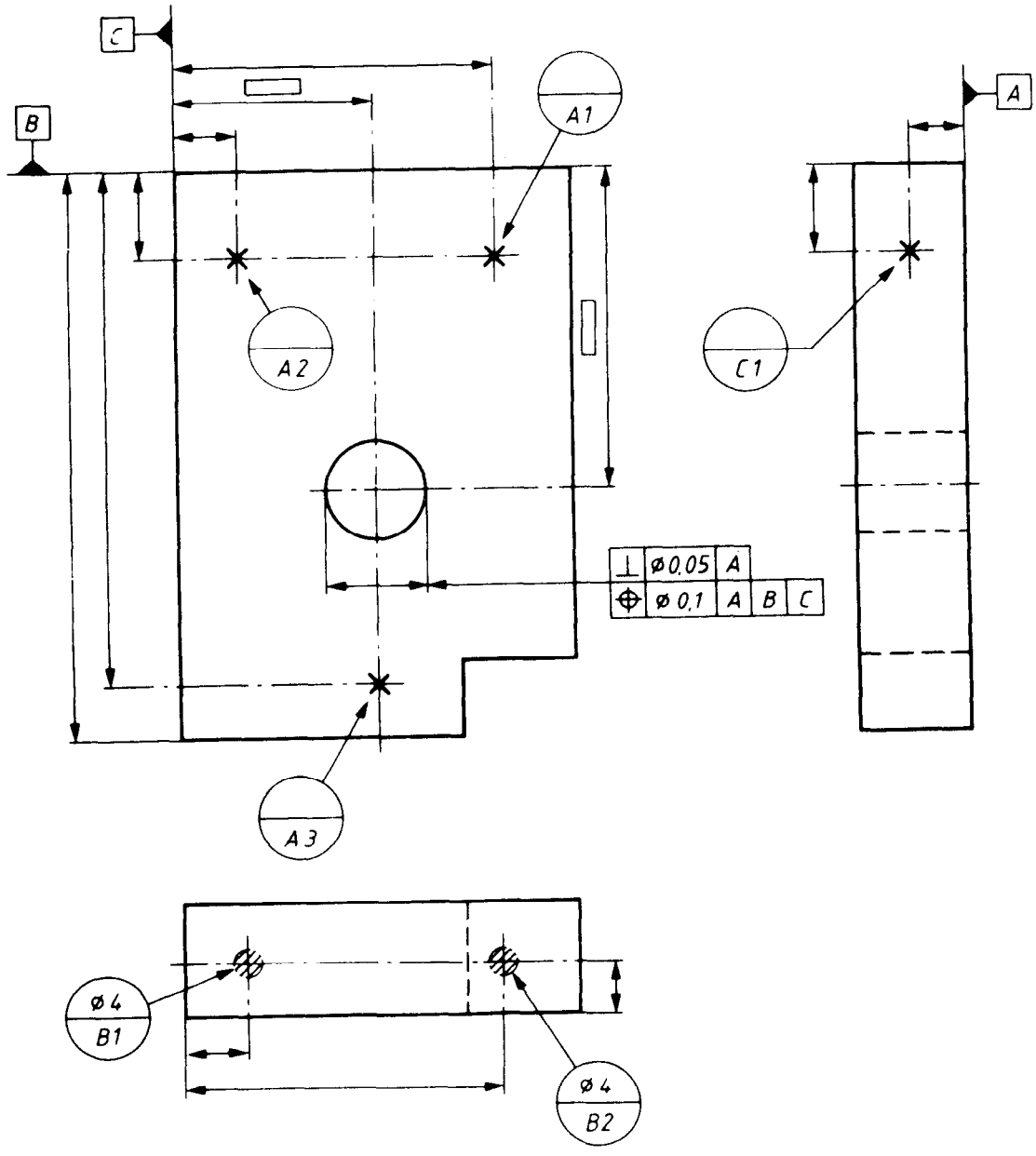


Figure 41

7.2 Application of the datum targets

Example 1

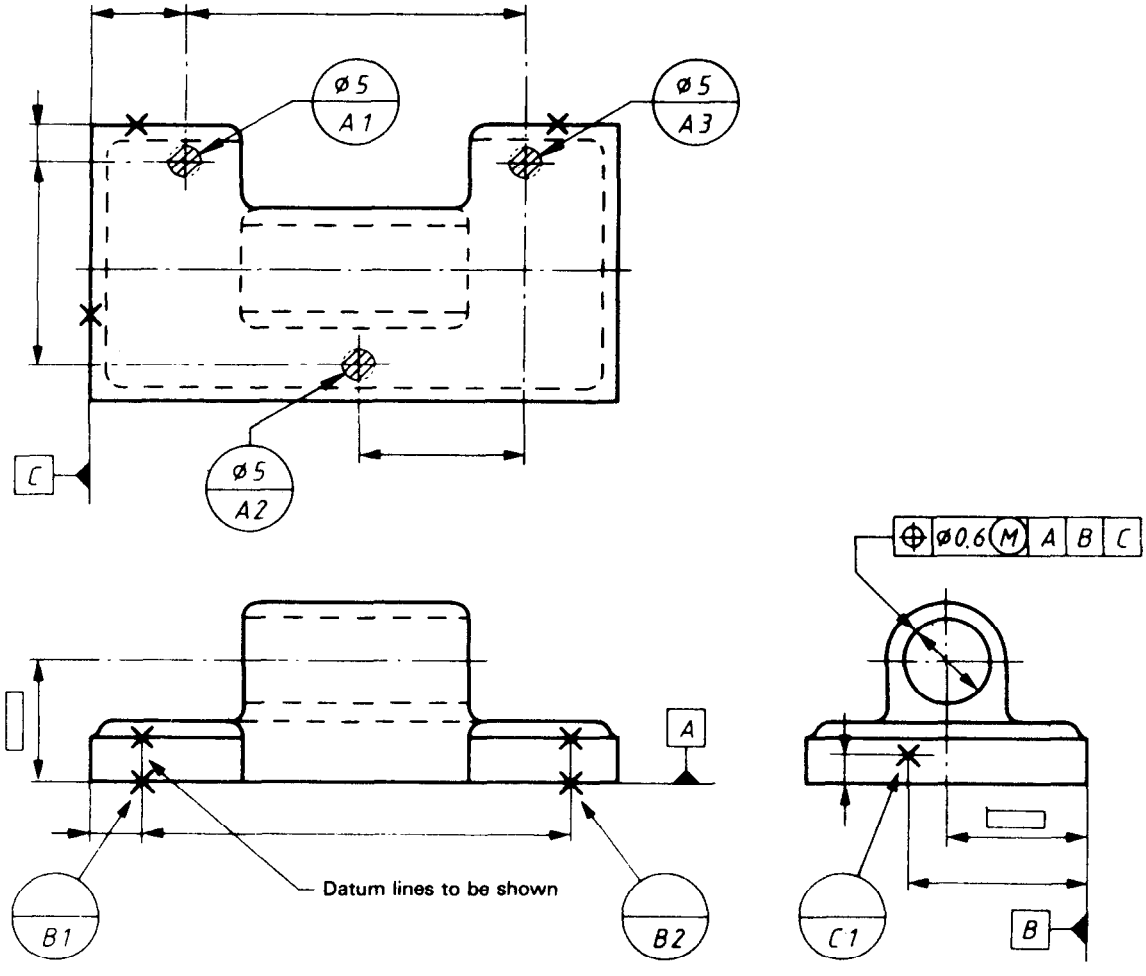


Interpretation :

Datum targets "A1", "A2" and "A3" establish	datum "A"
Datum targets "B1" and "B2" establish	datum "B"
Datum target "C1" establishes	datum "C"

Figure 42

Example 2



Interpretation :

Datum targets "A1", "A2" and "A3" establish datum "A"

Datum targets "B1" and "B2" establish datum "B"

Datum target "C1" establishes datum "C"

Figure 43

8 Three-plane datum-system

Usually only one or two datums are required for orientation tolerances; positional relationships, however, often require a three-plane datum-system in which the three planes are mutually perpendicular. It may be necessary to decide the order of precedence.

These planes may be considered as :

Primary
Secondary } datum plane
Tertiary

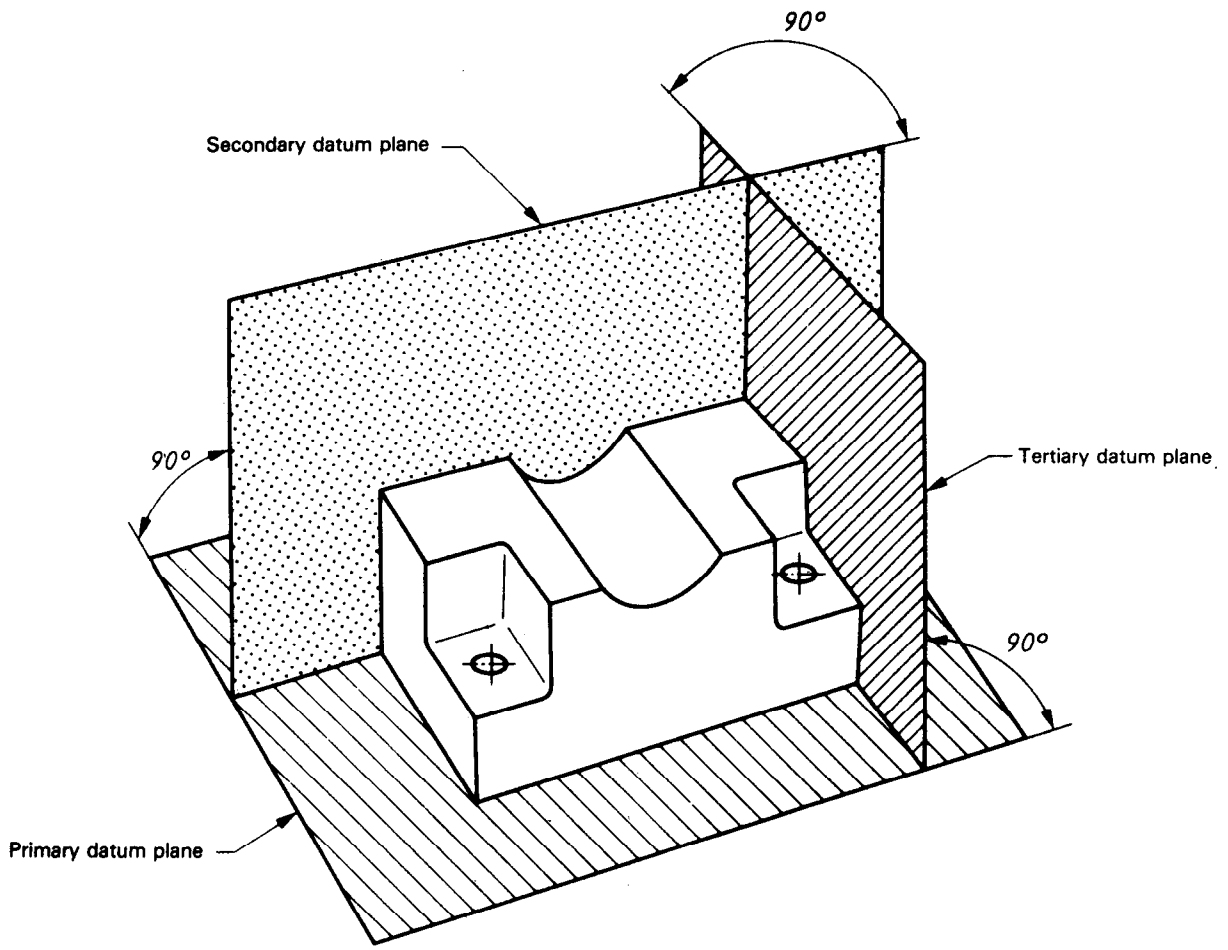


Figure 44

In cases where datum targets are necessary in the three-plane datum-system, they may be applied as follows :

Primary datum = 3 datum targets (points or areas)

or

Secondary datum = 2 datum targets (points or areas)

or

Tertiary datum = 1 datum target (point or area).

9 Groups of features nominated as datums

When it is a design requirement that the actual position of a group of features (holes) is to be the datum for a further feature or group of features, it can be shown on the drawing as in figure 45 with the datum identification-triangle connected to the tolerance frame.

Example

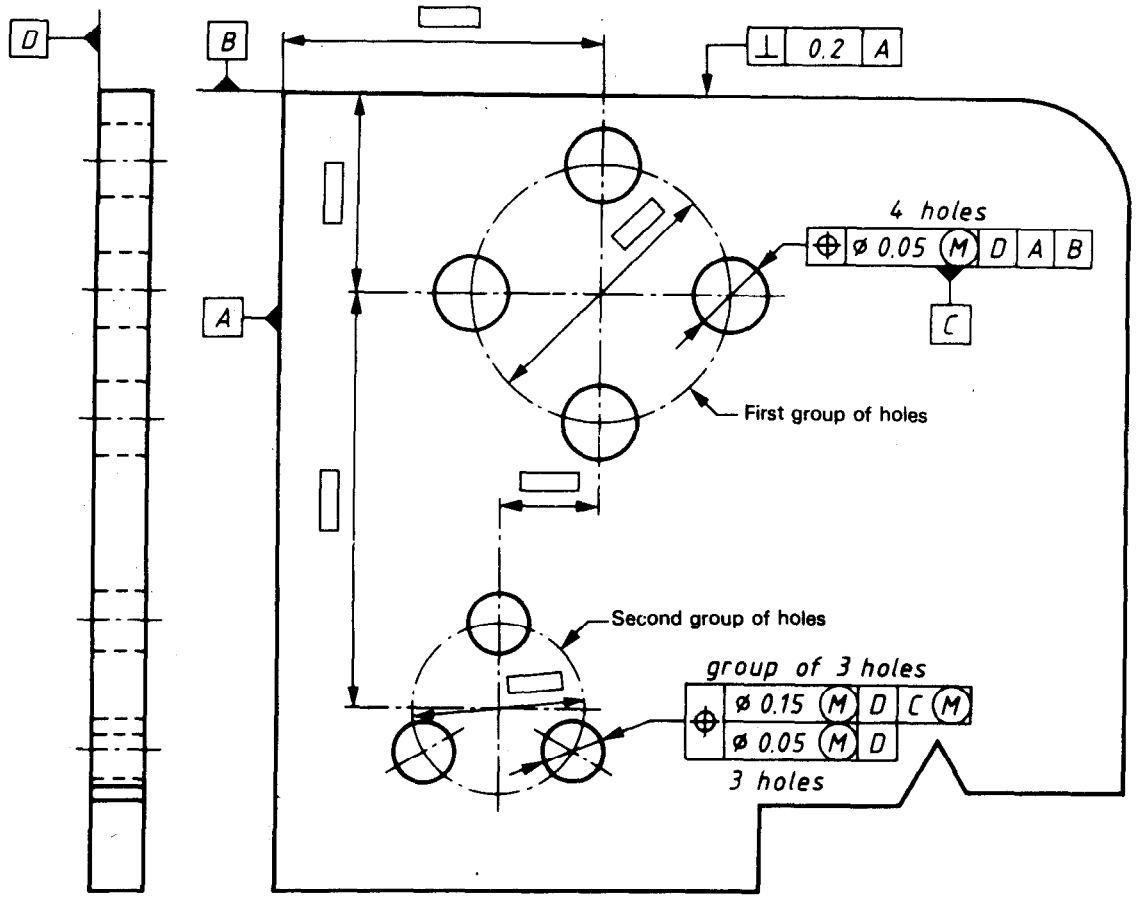


Figure 45

The first group of 4 holes establishes the datum "C".

The second group of 3 holes requires, in this example, a finer position tolerance between the features of the second group than the position tolerance of the whole group to the datum "C".

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